Stanford Library
MAR 31 1944
Cubberley Library

The American Biology Teacher

Vol. 6 MARCH, 1944 No. 6

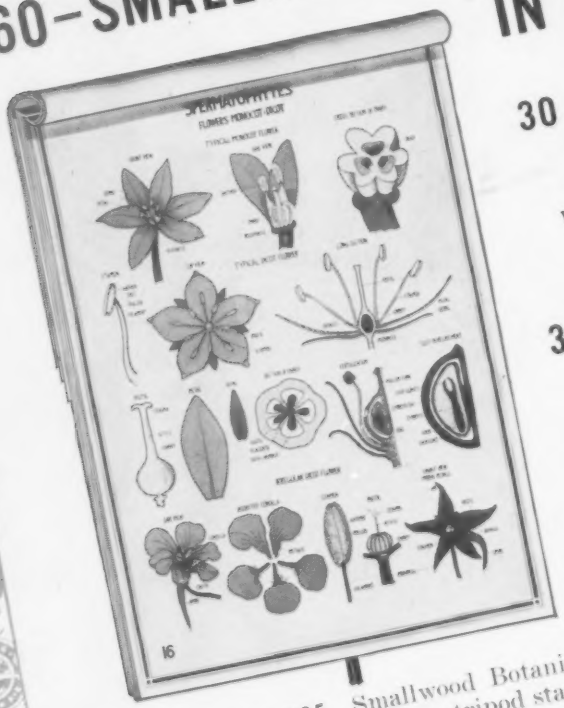
Medical Laboratory Techniques A War Course in Biology - 123
Planning a Small City Garden - - - - - - Lee A. Somers 126
Rodent Pests of Your Victory Garden - - G. C. Oderkirk 128
Our Nation's Health Lies in the Soil - - Ollie E. Fink 129
Collecting Spring Peepers - - - - - Donald S. LaCroix 138
Garden Education in the High School - - Paul H. Jones 139
Biological Briefs - - - - - - - 141
Reviews - - - - - - - - - - 142
Formulas for Biological Science 143
Notes and News - - - - - - 143

PUBLISHED BY
The National Association of Biology Teachers

Entered as second class matter October 26, 1939, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

TESTED AND APPROVED
milvay
SCIENCE LABORATORY EQUIPMENT

60–SMALLWOOD CHARTS–60 IN COLOR



30 BOTANICAL CHARTS

with more than 400 drawings

30 ZOOLOGICAL CHARTS

with more than 350 drawings

Meeting the requirements of all high school texts and manuals.

#92395	Smallwood Botanical Charts (30) on tripod stand	$27.50
#92396	Smallwood Zoological Charts (30) on tripod stand	27.50
#92397	Smallwood Biological Charts (all 60) on tripod stand	45.00

We will gladly send you a set for your inspection.
Order them today.

Chicago Apparatus Company

1735 NORTH ASHLAND AVENUE • CHICAGO 22, ILLINOIS

B & L Wide Field Stereoscopic Binocular Microscope AKW

From Foods to Firearms

All along America's war production line, from its start with the raw materials in the field, through the laboratory to the final vital inspections, Bausch & Lomb Wide Field Stereoscopic Binocular Microscopes are at work.

They are helping in the quality control and processing of foods to feed the United Nations . . . in the manufacture and inspection of arms for all the forces of Freedom. They are in daily use in the field, in the laboratory and the shop. Filling the gap in magnification between the hand lens and the compound microscope, the Wide Field Binocular Microscope offers a three-dimensional view of the object under examination. The user sees the object under magnification, but with full perception of depth and perspective.

Like many other Bausch & Lomb instruments developed for the peacetime needs of education, research and industry, today the B&L Wide Field Binocular Microscope is serving America's wartime needs . . . taking a place beside the actual instruments of war which B&L manufactures.

Here again, because of its wartime accomplishments, Bausch & Lomb will be able to extend its optical services to peacetime pursuits when Victory is won.

For Bausch & Lomb Instruments essential to Victory—priorities govern delivery schedules.

BAUSCH & LOMB

OPTICAL CO. • ROCHESTER, NEW YORK

ESTABLISHED 1853

AN AMERICAN SCIENTIFIC INSTITUTION PRODUCING OPTICAL GLASS AND INSTRUMENTS FOR MILITARY USE, EDUCATION, RESEARCH, INDUSTRY AND EYESIGHT CORRECTION

Inexpensive Life Histories

These life histories are put up in standard size, wide mouth 32 ounce clear glass jars with molded bakelite covers. Specimens are securely attached to glass plate and stages are labeled.

ZD211 Turtle

ZD72 Crayfish. Female with eggs on swimmerettes and 6 stages of young crayfish **$3.50**

ZD91 Red Legged Grasshopper. Instar stages one to five and adult male and female. **$3.50**

ZD97 Colorado Potato Beetle. Egg mass, larva, pupa, and adult male and female **$3.50**

ZD99 Honey Bee. Piece of worker brood comb, 3 larvae, pupa, worker, drone and queen **$4.00**

ZD190 Trout. Spawn, 3 embryo stages, young fish 6 weeks, 3 months and 1 year old .. **$6.25**

ZD210 Grassfrog. Eggs, 6 tadpole stages, external gills, hind leg buds, 2 legs, front leg buds, 4 legs long tail, 4 legs short tail, and young frog **$6.25**

ZD211 Turtle. Egg, 4 embryo stages before hatching and young turtle **$6.25**

ZD227 Chicken. Embryos of 3, 6, 9, and 12 days, hatching stage in dissected shell .. **$6.25**

ZD230 Pig. 6 embryos measuring 10, 20, 30, 40, 50, and 60 mm. **$6.25**

Buy Set ZD900. Save 10%. The nine life history mounts offered here when purchased as a set are priced at **$41.00.**

ZD227 Chicken

DENOYER-GEPPERT COMPANY

5235 Ravenswood Ave. **Chicago 40, Illinois**

CAROLINA CULTURES

A DEPENDABLE CULTURE SERVICE

L 1 Giant **Amoeba proteus** (standard for study).

Class of 25 (container and postage)	$2.00
Class of 50 (container and postage)	3.50
Class of 75 (container and postage)	4.75
Class of 100 (container and postage)	6.00

Same price as above: *Paramecium caudatum, Stentor, Vorticella, Peranema, Volvox, Mixed Protozoa, Anguillula or "Vinegar eels," Polytomella, Chlamydomonas, Pandorina, Eudorina, Actinosphaerium, Spirostomum, Aelosoma* (fresh-water annelid).

L 2 **Paramecium multimicronucleatum** (giant form of Paramecia, excellent for laboratory study).

Class of 25 (container and postage)	$1.50
Class of 50 (container and postage)	2.50
Class of 75 (container and postage)	3.25
Class of 100 (container and postage)	4.00

Same price as L 2: *Euglena, Arcella, Chilomonas, Daphnia, Copepods, Centropyxis, Diatoms.*

L 60 Hydra, Green or Brown (state preference).

Class of 25 (container and postage)	$1.50
Class of 50 (container and postage)	2.50
Class of 75 (container and postage)	3.25
Class of 100 (container and postage)	4.00

Same price as Hydra: *Spirogyra, Nitella, Elodea, Cabomba, Myriophyllum.*

L 220 **Planaria maculata** or **dorotocephala** (the former or light colored species is generally preferred).

Class of 25 (container and postage)	$1.75
Class of 50 (container and postage)	3.00
Class of 75 (container and postage)	4.00
Class of 100 (container and postage)	5.00

For Drosophila cultures. Tenebrio or "Meal-Worms," Aquarium Sets or Assortments, living Frogs, Turtles, Rats, Mice, etc., see our catalogue number 16.

We have a complete line of Preserved Specimens, Microscopic Slides, Dissecting Instruments, etc. Our publications—Carolina Tips and Catalogue number 16 will be sent free upon application.

CAROLINA BIOLOGICAL SUPPLY CO.

ELON COLLEGE, NORTH CAROLINA

For over fifty years the **MARINE BIOLOGICAL LABORATORY** has supplied schools, colleges and hospitals with dependable biological material. The Laboratory has a staff of many years' experience and our goods are guaranteed to give absolute satisfaction.

Catalogue on request

Address Supply Department
Marine Biological Laboratory
Woods Hole, Mass.

THE AMERICAN BIOLOGY TEACHER

Publication of the National Association of Biology Teachers.

Issued monthly during the school year from October to May.

Publication Office—N. Queen St. and McGovern Ave., Lancaster, Pa.

Editor-in-Chief—JOHN BREUKELMAN, State Teachers College, Emporia, Kan.

Managing Editor—CHAS. B. PRICE, 7449 Stewart Ave., Chicago, Ill.

Subscriptions, renewals, and notices of change of address should be sent to the Secretary-Treasurer, G. W. JEFFERS, Farmville, Va.

The entire Staff List will be found in the October and February issues.

Annual membership, including subscription, $1.50.

The American Biology Teacher

Vol. 6 MARCH, 1944 No. 6

Medical Laboratory Techniques

A War Course in Applied Biology

This course, outlined below, has been given successfully to 11th and 12th grade students in New York high schools. Many of the students who have taken it have already found their places in medical laboratories in the armed forces and civilian life. In view of the departure of many trained laboratory technicians from hospitals and medical laboratories, it is necessary for the schools to help replace these losses.

Naturally, the students who have taken this course are not immediately competent to take the place of a medical technician. But they can do simple tasks in the laboratory and they can add to their store of knowledge much more rapidly than can students who—willy-nilly—are placed in such laboratory positions without training.

The course is designed to prepare students in the techniques which are basic in medical laboratories and clinics. It has been prepared with the advice and assistance of army and civilian authorities and is designed for students on the pre-induction level. It is intended to prepare boys for further training for such army ratings as Medical Technician, Male Nurse, and the navy rating, Pharmacist's Mate. Girls will be prepared to assist materially in those civilian services which have been seriously impaired through withdrawal of men for active duty, *e.g.*, hospitals, clinics, etc. (industrial and medical).

Boys and girls who have been successful in science and are preparing to enter the study of medicine, nursing or clinical laboratory work should be encouraged to take this course.

In New York the course is set up for two terms of 15 weeks each. The usual length of time spent on each subdivision is indicated in number of periods. These periods are 45 minutes in length, but adjustments can easily be made for other lengths, as also for semesters of other length. The laboratory part of the course is flexible enough to permit adjustment to individual variations in the intelligence and aptitude of the students, as well as to the equipment and space available. Some adaptation to the training of the teacher may be necessary.

In New York the committee has been supplying certain materials, slides and the like. In other places these may be

obtained from slaughter houses, Board of Health laboratories, University departments of bacteriology and parasitology, and various other sources. For slaughter house materials in parasitology, it is necessary to obtain a permit from the United States Department of Agriculture, Bureau of Animal Industry, Washington, D. C. In some places it may be necessary to consult local or state health authorities. The city, county or state Board of Health may be consulted for information on this matter, as well as in the field of visual aids, films, charts, and the like.

Parts I and II may be given separately or in sequence. It is desirable that students who are assigned to these courses have preliminary training in both biology and chemistry. Part I can, however, be given to students who have had biology only. Chemistry may be taken concurrently with the course.

In the outline, the following abbreviations are used: D, demonstration; L, individual laboratory work; Disc., discussion. Many of the individual laboratory experiments could also be done by demonstration, if necessary on account of lack of space, time or equipment.*

Part I

Bacteriological Techniques

I. *Fundamental laboratory practices,* 16 periods
- A. Care of laboratory animals (rabbits, mice, guinea pigs, rats), diet, care of cages, diseases, breeding, 4 periods (D, Disc.)
- B. Maintenance of equipment, 6 periods
  1. Stills, incubators, sterilizers (autoclaves, Arnold sterilizers, dry heat sterilizers) (D)
  2. Glassware. Identification, care, and use of: pipettes (volumetric), graduate cylinders, burettes, volumetric flasks, slides and coverslips, beakers, flasks, funnels, and other glassware used in this course (D,L)
  3. Surgical instruments. Identification, care, scalpels, scissors, forceps, hypodermics, dissecting needles, etc. (D,L)
  4. Analytical balance and trip scale, use and care of weights, metric system (D,L)
- C. Preparation of solutions, 6 periods
  1. Preparation of distilled water (D,L)
  2. Preparation of percent solutions, saline, acids and bases (L)
  3. Preparation of stains (L)

II. *Bacteriological materials and equipment,* 10 periods
- A. Preparation and sterilization of bacteriological materials, 4 periods
  1. Sponges, applicators, and tongue depressors (D)
  2. Petri dishes, flasks, test tubes, and pipettes (D,L)
  3. Nichrome needles (L)
- B. Sterilization of equipment, 6 periods

III. *Preparation and sterilization of culture media,* 6 periods
- A. Preparation of basic broths, agar and gelatin (L)
- B. Adjustment of pH (Disc., D, L)
- C. Tubing and sterilization of bacterial media, sterility tests (incubation) (L)

IV. *Bacteriological culture methods,* 11 periods
- A. Methods of transplantation; use of needle and sterile pipettes, principles of aseptic techniques, slants; Petri dishes, broth culture methods (L)
- B. Aerobic and anaerobic culture methods (L)
- C. Stock cultures of known (harmless) bacteria, individual maintenance (L)
- D. Study of colony characteristics in Petri dish cultures (D or L)
- E. Purification of contaminated cultures, plating out (L)

V. *Bacteriological staining methods,* 11 periods (L)
- A. The hanging drop
- B. General stains; gentian violet and methylene blue
- C. Gram stain: negative and positive differentiation

* The following syllabus was printed, in similar form, in The Teaching Biologist for February 1943 and October 1943.

D. Spore stain: carbol fuchsin
E. Acid fast stain

VI. *General diagnostic procedures,* 6 periods
A. Study of types important in human disease from prepared slides (L)
B. Staining of killed smears (L)
1. Tuberculosis sputum: acid fast stain. (Mix Mycobacterium smegmatis with sputum.)
2. Anthrax and tetanus: spore stain. (Use B. subtilis.)
3. Diphtheria: Loeffler's methylene blue
4. Gonorrheal pus: Gram stain. (Obtain from Board of Health.)
5. Meningococcal spinal fluid: Gram stain. (Obtain from Board of Health.)
6. Typhoid, dysentery: Gram stain. (Use B. coli.)

VII. *Principles of serology,* 6 periods
A. Preparation and counting of vaccines (L,D)
(Kill B. coli and count by Wright's method.)
B. Widal agglutination test. (B. coli) (L)
C. Pipetting methods used in precipitation and Wassermann tests (L)
D. Preparation of serum from blood (Disc. or D)

PART II

Medical Techniques

I. *Haematology,* 17 periods
A. Blood components (cells and plasma), 2 periods
B. Blood microscopy. (Beef blood may be obtained from a butcher; frog blood may be used.)
1. Staining methods for blood smears, 5 periods
a. Wright and Giemsa stains techniques (L)
b. Differential leucocyte counts (L,D)
2. Cell counts, 5 periods
a. Use of the haemocytometer (D,L)
b. Red and white cell counts
3. Blood pathology. Study of the blood picture in infections, leukemia, anemia, and malaria, 5 periods (D, Disc.) (Optional, should be given if time is available. This depends on the speed with which the exercises above have been accomplished. Also depends upon the training and experience of the teacher.)
C. Hemoglobin determination, 2 periods (L)
(Tallquist or Sahli methods; both if time is available.)
D. Blood coagulation time, 2 periods (L, D, Disc.)
E. Sedimentation rate, 2 periods (L, D, Disc.)
F. Blood typing, open slide method, 2 periods (L, D, Disc.)

II. *Urinalysis,* 6 periods
A. Specific gravity, total solids, 3 periods (D or L)
B. Microscopic examination; pus, epithelial cells, red blood cells, crystals, casts, 3 periods (D, Disc., L)
C. Chemical tests, 15 periods
1. Qualitative tests; glucose, albumin, acetone, blood, pH, sulfanilimide, 12 periods (L)
2. Quantitative tests, 3 periods
a. Glucose (L)
b. Principles of biometric method (D, Disc.)

III. *Blood chemistry,* 3 periods
A. Blood glucose (home made colorimiter) (D)
B. Blood sulfanilimide (D)
(Optional, if time is available)

IV. *Parasitology,* variable number of periods
A. Parasitic protozoa (L or D)
1. Examination of blood parasites (malaria, trypanosomes) (dead material)
2. Examination of excreta (animal feces, optional, if dead, sterile, material is available).
3. Frog intestine (Opalina, Nycototherus, etc.)
B. Parasitic worms, 5 periods (L,D) Examination of tapeworms, trichina, roundworms, hookworms, flukes, prepared slides, wet mounts, frog lung, slaughterhouse material. (Optional, if time is available.)

Recommended References

1. *Methods for Laboratory Technicians.* Technical Manual. (TM 8-227)

2. Hawk, P. B. and Bergheim, O.—*Practical Physiological Chemistry.* P. Blakiston's Son & Co., Philadelphia. 1937.
3. Freder, J. M.—*The Essentials of Applied Medical Laboratory Technic.* Charlotte Medical Press. 1940.
4. Gradwohl, R. B. H.—*Clinical Laboratory Methods and Diagnosis.* C. V. Mosby Co., St. Louis, 2 ed. 1938.
5. Todd, J. C. and Sanford, A. H.—*Clinical Diagnosis by Laboratory Methods.* W. B. Saunders Co., Philadelphia, 8 ed. 1937.
6. Best, C. H. and Taylor, N. B.—*The Physiological Basis of Medical Practise.* Williams and Wilkins Co., Baltimore. 1937.

This syllabus was prepared by the following committee:

Paul F. Brandwein (Chairman), Forest Hills High School
Jerome Hamburger, Far Rockaway High School
Harold Nagler, Franklin K. Lane High School
Morris Rabinowitz, Grover Cleveland High School
David F. Sygoda, Grover Cleveland High School
Charles Tanzer, Bronx High School of Science
Robert Tolle, Stuyvesant High School

Planning A Small City Garden

LEE A. SOMERS
Associate in Vegetable Gardening Extension, University of Illinois

When we have a small city garden, the site has usually been fixed by circumstances. It is our own backyard garden or it is part of a community garden. We can, however, look to some of its characteristics and see if they cannot be improved. Frequently in our backyards there is too much shade. Possibly we could change locations slightly or maybe some tree that we do not care for is casting its shade over the garden. Roughly we say that if an area does not receive *six hours of sunlight* on a sunny day, it should not be used for gardening purposes. We can also look to the drainage, at least to the surface drainage, and see whether or not excess water would run off following a heavy rain. Sub-surface drainage is much more difficult to see but frequently we can make some decision about it.

The fertility of the soil again has been fixed by circumstances of the past years. Frequently in the city the area has been graded up or possibly it has been graded down or it has been modified by ashes, bricks or cinders being thrown on it. One should make sure that the physical condition of the soil is not beyond hope of repair.

After we are satisfied with the physical condition of the soil, we must look to its fertility. Does it contain the plant foods necessary to good vigorous growth? If not, it is likely that we had better buy some fertilizers which contain these elements. Soil tests on little areas are of practically no value, but we can gain a great deal of knowledge concerning the fertility of the soil by looking at the residues of last year's crop or by looking at the weeds or grasses along the fence rows to determine whether or not they grew vigorously. In practically all cases we would do well to invest in a small amount of a well balanced fertilizer. The 4–12–4 fertilizer formula* has been approved for use in Victory gardens in the Mid-West. While this is not the ideal formula, it certainly is very much better than the 3–8–7 which was approved during the 1943 season. Since it is impossible to apply the fertilizer differently for each different crop and each different

* Contains 4% nitrogen, 12% phosphorus and 4% potash.

set of conditions, the general recommendation is that the fertilizer be applied to the soil before plowing or spading.

We are now ready to spend some time in our homes planning the garden. In January the seed catalogues begin to arrive and it is a pleasant diversion to spend one or two evenings trying to plan our successive plantings. It is obvious, of course, that there are many plants that cannot be used in the small city garden. If one does not own the land, there can be no planting of the perennials—asparagus, rhubarb or winter onions. If the area is small, there can be no planting of the vine crops other than possibly the cucumber. So too we must give thought to whether or not we have room to grow potatoes. In general, the small city garden should be used to grow those leafy vegetables that deteriorate very rapidly after harvest and in which freshness is the principal factor of quality. Among these are radishes, leaf lettuce, spinach, peas, beans, lima beans and sweet corn. Cabbage deteriorates less rapidly and, therefore, could be left out. Potatoes on the other hand are but little effected by freshness and generally should be left out of the very small garden.

We need too to consider the balance and the amounts. The garden should provide us with salad crops and green crops at all times. There is a tendency to plan all together too much of one kind with none at all of another kind.

Having decided what we will grow and the amount that we will grow, our next thought must be given to the time of planting. Our vegetable crops come to us from as far north as the Arctic Circle and as far south as the Equator. They vary from crops that can grow only when the soil is cool and moist to crops that cannot grow until the soil is definitely warm and somewhat dry. The definitely cool season crops which are often referred to as hardy crops are the radishes, lettuce, spinach, mustard, peas, turnips and kohlrabi. Potatoes and onions also fall in this class. These should be planted as soon as the soil can be worked in the spring. The moderately cool season crops which include the transplanted cabbage, cauliflower, broccoli, and the other root crops such as carrots, beets and parsnips should be planted about ten days to two weeks later than the first group. Among the tender rapidly growing warm season crops that are planted as soon as danger of frost is past are snap beans and sweet corn. The first planting is made as soon as possible and successive plants of these crops are made for several weeks thereafter. The definitely warm season crops including the tomato, pepper, eggplant and sweet potato—all of which are transplanted—must not be put in the field until some time after the planting of beans and corn. These crops all have their nativity in the warmer parts of the world.

If we are planning our first garden, it is necessary that we also plan our tools and supplies. It is true that one can have a small Victory garden with practically no tools at all—yet it is necessary to have some tools. We will have to have a hoe. In most instances we will have to have a rake and a spade. If there is any choice in the matter, buy good grade steel tools that will last for many years and that have enough steel in them to take a sharp edge. In our small hand tools we can get along with only one trowel and one or two dibbers. Unfortunately there are many trowels that are made of such a material as to be entirely worthless. The purchase of good tools is one important step in good gardening.

Rodent Pests of Your Victory Garden

G. C. ODERKIRK
United States Department of Interior, District Agent, Predator and Rodent Control, West Lafayette, Indiana

Only slight damage was inflicted by rodents and birds in Victory gardens during the past season. Here and there cottontail rabbits, rats, and a few other species caused some concern but the loss was, on the whole, inconsequential. However, next year may be a different story. Rodent populations fluctuate in a more or less cyclic manner and some species, as for example field mice, may increase to fairly large numbers within a year's time.

Most of the injury inflicted by rodents, and we can include moles with this group, can be avoided by reducing infestations in and near garden areas well in advance of the garden season. Rabbits, rats, and field mice should receive attention during the winter and spring months. Other rodent species that hibernate during the winter, such as ground squirrels and woodchucks, can be best controlled in early spring. Moles do not hibernate but they are relatively inactive during the winter and it is likewise necessary to wait until early spring, when they make their runways near the surface of the ground, before control measures can be applied with the best results.

Rats were particularly troublesome in many urban gardens last year and they will likely be a damaging pest during the next gardening season. Unified effort on the part of people in a community in removing the sources of food and shelter for rats will aid greatly in their control. Methods of destroying this pest should likewise be applied on a community basis.

Cottontail rabbits are a perennial threat to certain garden crops. These likeable though frequently destructive little animals have moved from pastures and woodlands to the very heart of our busy cities. Apparently, the shrubs and other lawn plantings on residential as well as some business properties provide ample protective cover for them. Trapping is the most practical method of rabbit control in the hands of the average person. However, the choice of the control method to prevent damage by rabbits or other injurious species will depend to quite an extent upon local conditions as well as the habits of the animal pest. The poisoned bait method can be used to reduce an infestation of most rodents no doubt much easier than through the use of traps but there is the element of danger involved in the application of poisons in and around cities. Similarly the use of guns to shoot and destroy rabbits may be easier than to take the animals with traps but local ordinances prohibit the use of firearms for this purpose in most urban and suburban communities. Hence it is advisable for people in most communities in or bordering cities to rely mainly on the use of traps and frightening devices so far as possible to reduce the infestation or otherwise prevent damage by moles, birds, rabbits, and rodent pests.

Detailed information concerning the control of animal pests will be found in

(*Continued on page 137*)

Conservation Series, Unit II
Our Nation's Health Lies in the Soil

OLLIE E. FINK
Curriculum Supervisor, Conservation Education, State of Ohio.

The quality and power of a nation is dependent upon its citizens and its natural resources. With the proper development of these two factors, a nation will rise to new levels of prosperity and greatness. History shows that the quality of citizenship usually goes hand in hand with a degree of conservation of their natural resources. Great nations, once noble and rich, have been evicted from the landscape as the citizenship failed in their responsibilities in regard to saving their fundamental resources, especially those of soil and water.

We have hurt the land. We all live on or from the soil. Soil misuse makes people poor. Land laid to waste will not support an America that will be forever strong and secure. Soil debility soon removes the stiffening line from the national backbone, lowers the beat and vigor from the national blood stream and leads to a devitalized society. From an economic viewpoint, it should be apparent to all that our future prosperity and greatness rests upon the storehouse of natural resources. It is only, however, when the citizens of a country are rugged, hardy and resourceful that these resources may be developed. A nation which loses its health and vigor through losing the fertility of its soil soon loses its place among nations. The purpose of this paper is to discuss our nation's health and how it lies in the soil—probably the most important problem before the American civilization, in the post-war period. If the problem is to be solved in time to assure our continued national prosperity and greatness, the teachers must become militant in teaching conservation. The teaching motives should be both professionally selfish and thoroughly patriotic in service to the nation.

Health from the Soil

The soil is the starting point in human health. Until recently, discussions of nutrition were limited to a consideration of the selection, purchase, preservation, and preparation of food. Recent studies indicate that in the study of nutrition, we must begin with the soil, that is, we must study nutrition "from the ground up."

The fact that different soils have an important bearing on the diet and the health of the inhabitants of a region was observed and reported by Dr. Robert McCarrison, *Journal of the American Medical Association,* in January 1922. At one time, he was stationed among an isolated group of natives in one of the more remote parts of India. This was a remarkably healthy group of people. They were agriculturalists and lived largely on grains and dairy products. Part of the tribe, however, migrated to a region not very distant from their original home, but where the soil was much poorer. They were no longer able to raise the foods to which they were accustomed. As a result, the health of the emigrant group deteriorated greatly. In this case, dietary inadequacy was largely the result of an inferior soil, for the dietary habits and even the farming

traditions were the same as those of the parent group.

Poor soils result in frail human bodies. For normal health, your body needs some fifteen and perhaps more distinct mineral elements. Moreover, for most of the minerals, the requirements are quantitatively very specific; too little of any given element will be followed by certain definite symptoms of ill health; too much of at least some of them will provoke other maladies. The mineral requirements also change from age to age. For example, the bone building elements of calcium and phosphorus are present in much smaller quantities in babies than in grownups.

Quality foods come from quality soils. Both the nutrient quantities and qualities of minerals as well as the vitamin content are influenced by the soils in which the plants are grown. Unfortunately, we have farmed the mineral elements from our soils through faulty practices and substituted crops which require less of these chemical nutrients. America's greatness has been built at the expense of the withdrawal of these life-giving minerals from our soils. In a sample of soil of average fertility, one-half of the chemical nutrients consist of the mineral elements returned to the soil through the decomposition of plants and animals. Eroded soil is soil in some part dead, devitalized. Soil debility, soon reflected in nutritional deficiencies, spreads undernourishment. If the soil does not have it in it, plants that grow there do not, nor do the animals that eat those plants; nor the people throughout a country who eat those plants and animals.

The concentration of nutrient minerals within any form of plant life is extremely small. The contribution which water and air makes to plant life is not well understood or appreciated by the average person. An experiment conducted some 350 years ago illustrates the importance of water to plants. One of the early scientists, the chemist, Jan Baptiste Van Helmont, performed the following experiment which might well be followed by every school in our nation. After carefully drying 200 pounds of soil in an oven, he placed it in an earthen vessel. A small willow tree weighing 16 pounds was planted in the soil. After five years of growth, the tree weighed 169 pounds. The earthen vessel during this period had been kept closed with an iron lid coated with tin. During this five-year period, only rain, water or distilled water had been added to the interior of this covered vessel. When the tree was removed, the soil was again oven dried and weighed. According to the report, there *still remained the original two hundred pounds of soil less two ounces. The additional weight of the tree was derived from water and elements manufactured from the atmosphere.* The air-borne nutrients of carbon, hydrogen, oxygen and nitrogen constitute 95% of the plant and animal bulk.

Thus we see that of the "construction units" utilized in building plant and animal bodies, only 5% is contributed by the soil. In other words, man is about 5% soil or 5% ash. The list of elements coming from the soil includes calcium which makes up 1.6% of the normal body weight. Calcium makes up 42% of the body minerals. The next element is phosphorus with 0.9% body weight. The other elements of soil origin come in the following order: potassium, 0.4; sodium, 0.3; chlorine, 0.3; sulphur, 0.2; magnesium, 0.05; and iron, 0.004%. There are traces of iodine, fluorine, silica, manganese and others. Plants require the same elements as animals except that animals demand two and perhaps a few more of which the essentiality is still in doubt. The dozen chemical elements coming directly from the soil are the "construction units," the building stones of our bodies. If the soil contributes these dozen nutrient elements liberally to our foods and we do not destroy them in preparing our foods, a healthy nation results. If they are delivered

stintingly, we have an unhealthy people and along with this unfortunate condition, a series of unfavorable social and economic conditions.

You are a speck—plus food. The speck that is to become a tree, becomes a tree through food. The speck is to become a horse, becomes it through food. We live by the food we eat. The food comes from the soil and air directly and indirectly. An adult body, 150 pounds, contains about 7½ pounds of soil elements. Life without any one of them becomes impossible. The soil is the starting point in human health.

Your students may not be aware of probably the most important struggle in their lives. That struggle in plants and animals is the problem of increasing the concentration of mineral elements from the ratio found in the soil to that necessary in maintaining life. For example, calcium may increase eight-fold in plants and further increased to 40-fold in animals. As calcium becomes less dominant in the soil because of weathering, potassium becomes more dominant and the elimination of its excess in animal foods becomes a critical problem. Phosphorus constitutes only about one part in 1000 of the earth's crust. Plants (dry weight) require about 30 parts per 1000 while animals with skeletons (dry weight) require the ratio of 100 parts in 1000. The only source of phosphorus for the plants is the soil in which they grow. Usually the top seven inches of an acre of ground contains only about 1000 pounds of phosphorus in a form in which the plants can use it. A 60-bushel-per-acre crop of wheat or corn will remove from the soil about 25 pounds of phosphorus per acre. Therefore, we find in an average soil enough phosphorus for only 40 crops. After these minerals are exhausted, the field is ready to be abandoned except as nature's "building blocks" are returned to the soil in the form of fertilizers. In nature's program, plants and animals return to the earth what they borrow. The roots of plants bring up the required minerals from the soil and subsoil and these are later deposited as leaves, stems and trunks to decay usually on the surface. Thus nature rebuilds and enriches the topsoil.

Plants are widely different in their chemical composition. These differences occur primarily as a result of what the soil offers in nutrients. Plants are thus distributed over the surface of the earth according as they are nourished to provide the particular chemical composition which they, as species, represent. In earlier years, it was generally believed that when soil and climatic conditions were such that plant growth resulted, the plants' chemical composition would show little variation. Another long held belief was that the meteorological conditions determined the plants in any locality. We have scoured the world making transplants with great attention given to climate but with little regard for the soil fertility.

Energy and Repair

In our automobile, we must provide fuel as energy. We replace worn out parts with new ones. We also burn fuel to obtain the working energy for our bodies. Unfortunately, we cannot purchase new parts for the human body as they become worn and defective. Nature's plan however is that in our diet we include not only the energy foods to obtain our working energy, but also include an adequate supply of body building and repairing nutrients. We must eat "grow" foods as well as "go" foods. If you eat too large a proportion of carbonaceous foods (from air and water), you are not maintaining the parts of the body in proper working condition. In the average American diet, it has been estimated that two-thirds of our calories consist of sugar and white-flour products. Sugar is almost 100% pure, carrying no vitamins and no minerals. White flour has less than one-fourth of its original vitamins and minerals as found in the whole-grain flour. Thus, in the average diet, we depend upon one-third of our diet to supply the vital minerals and vitamins.

Proteins and Minerals

Our nation's health lies in the soil. What type of food must we purchase in order to receive the nutritious elements

provided by the soil? The first important type of food is meats, because they provide protein. The nitrogen content is an important distinguishing factor of proteins. In order to provide legumes which can manufacture proteins, we need a liberal available store of soil minerals. The demands made on the soil nutrients by the legumes is greater than by the non-legumes. When legumes are provided with an ample store of minerals, especially calcium, phosphorus, nitrogen and potash in the soil, they can manufacture proteins from the nitrogen in the soil. In our better soils, leguminous plants may grow which have the ability to take nitrogen from the air and make it available in the soil through a process called nitrogen fixation. Remember then when we purchase high quality protein foods, they are the result of greater mineral and chemical contributions from the soil. We feed ourselves with protein by feeding the soil, to restore its mineral fertility.

One of the great medical discoveries of the past decade revealed through chemical investigations the fact that antibodies with which we resist diseases are molecules of a body-protein, globulin, which has been especially modified during its synthesis by contact with antigen. The medical profession, specializing in nutrition, realized for the first time that the continued production of antibodies within the tissues depends upon the latter's ability to make their own globulin. This manufacturing process in turn requires the adequate intake of protein in the food. Diet therefore assumes a more significant role in maintaining health than has heretofore been realized. Food proteins with a full complement of amino acids are essential for globulin production.

What is an antibody? It is a substance which the body forms to combat harmful bacteria or their poisons. The significance of the above medical discovery is that, as we reduce the protein content of our diet and therefore deplete the body protein reserves, we reduce the production of antibodies. The relation of food intake to antibody production always becomes increasingly important in the time of war. History records many tragic reports of famine and pestilence associated with wars. As the food supply becomes scarce, protein starvation comes, families sicken and die from infection since the body can no longer resist disease. The munition makers have priority and since "cows and cannons use the same fodder" the soil is deprived of this necessary and vital element required in the manufactured protein, the building stones of the body. Starving peoples in times of crisis are usually forced to subsist on foods of low protein value. This results from the fact that nitrogen is essential for the manufacture of explosives. In past wars, each succeeding year of its duration further deprived the soil of nitrogen applications. This, in turn, deprived the population of the protein-rich foods and their protection against disease and pestilence. Armies have altered the map of Europe only to find themselves powerless to escape from the pestilence and famine resulting from the depleted soil. This protein deficiency strikes both military and civilians in the conquering and in the conquered countries. Our own soils are being affected unfavorably now. Through the advances of science, however, it is probable that an adequate supply of nitrogen will be made available for our own military and agricultural purposes, during the remainder of this war.

A healthy body cannot be built from foods produced on mineral-deficient soils. Without adequate soil minerals, we are

producing foods manufactured primarily out of air and water. Such foods will provide us with energy but not with health. An adequate mineral content of food provides for the building of bones, blood and tissue. It may seem paradoxical that food should suddenly come to public and critical attention in this country when only recently we were plowing under surpluses. At this point, it should be explained that we have never produced enough quality foods. We refer to the fact that we are the healthiest nation in the world, yet we have had a high rejection of men called for military service because of the lack of physical fitness. We certainly cannot be proud of the state record with seven out of every ten called being rejected. This, from a state where the soil's contribution in minerals is extremely limited. It is a southern state with a high rainfall, which has eroded the soil and also leached calcium and other nutrients from what remains. Colorado, however, has a fine record of seven out of ten being accepted for military service. Colorado soils are less leached and therefore contribute greater quantities of calcium and other plant nutrients and from these, protein-rich plants healthy bodies grow.

The health of our nation as determined by the fertility of its soil is indicated by the above figures relative to the rejection of those called for military service.

The results of poor nutrition may be observed by biology students in a comparatively short time through rat-feeding experiments. A five-week test will correspond to a three-year period in human life. It would be well for the teacher to emphasize the fact that farm animals held to the food within the farm fence differ little from rats in a cage. A soil deficiency soon shows up in the animals. In fact, groups of people, such as a family, living on the same farm, with food from the same soil passing over the table daily, develop characteristics as a direct result of diet. Many of these family characteristics which were included in the courses dealing in inheritance in the medical schools 30 years ago are now recognized to be the results of family eating habits. In the nutrition laboratories, diseases may be produced in every organ of the experimental animals through the use of faulty foods. We are probably passing from a period in which bacteria were held of more clinical importance than diet to one in which the knowledge of diet is to be regarded of more importance. In a very large number of diseases, faulty food is the primary cause.

Size and Nutrition

We usually think of the size of horses in terms of breeding. The new science of soils indicates the possibilities of treating the fertility of soils in producing different sizes and kinds of horses. In the British Isles, a small land area, we may go from the smallest to the largest of horses as we move from the rocky undeveloped soils to those of greater clay content. The Shetland Pony, or the midget horse is at home on the rocky, and less developed soils of the island. High-grade, well-developed horses from England within three or four generations decrease in size to that of ponies when placed on the Faulkland Islands with their poorly developed mineral-deficient soil. If these ponies are returned to the good soil in England, their descendants within a few generations return to the original large size stock. An analysis of the vegetation on the Faulkland Islands shows an average of approximately 30% fiber when compared to only 20% on a good pasture in England. The calcium content of the En-

glish vegetation analyzed 2.473% while that on the Faulkland Islands was 0.225%. The analysis showed the Faulkland Islands soils correspondingly low in most of the essential nutrients.

Calcium and phosphorus, the more common deficiencies in soil fertility, when supplied to the soil, serve to make each acre from 50 to 100% more efficient in growing animals in Missouri. Balancing the soil fertility as diet for the plants increased the plant growth and the average yield. Improved physiology of the animal was also manifested and the body functions operated more efficiently. Supplemental feed along with the forage from untreated soils was not the equivalent of using feeds grown on treated soils. This fact suggests that calcium and phosphorus provided by plant growth processes do more for animal nutrition than merely delivering themselves to the animal's digestive system.

Several references have been made to the deficiency of calcium in our soils, a condition not only prevalent in this country, but throughout the world. Probably the most common dietary deficiency in livestock the world over is phosphorus. Agricultural literature is full of records of animals with soft bones, stiff, swollen joints and having perverted appetities which result in bone chewing. Recovery was usually immediate when a phosphorus supplement was used or the animal moved to a better soil. The research of Dr. William A. Albrecht of the University of Missouri has demonstrated that animal life behaves mainly according to how it is fed, consequently, the pattern of the soil stock of nutrient supplies—or what is called soil fertility — determines the plant pattern and the animal pattern in any nation and their condition of health.

A lettuce leaf is a lettuce leaf to the average housewife, but to the scientist, a lettuce leaf can either be "merely a lettuce leaf" or it can be a repository rich in vitamins and needed minerals, depending entirely upon the soil in which it is grown. It is possible to vary the calcium content of the salad leaf as much as sixty fold by varying the calcium content of the soil in which it is grown. With improper farm practices, the lime is the first to be washed out of the soil.

A farmer given his choice of two stacks of hay of equal size would probably give little attention to the difference in the analysis of the mineral content. Research at the University of Missouri has shown that a calcium content of 1.13% in one stack and 1.31% in another (a difference of only 0.18%) resulted in approximately one-third greater production in pounds when fed to lambs for a period of 98 days.

The bones in the photograph are from thoroughbred horses. The pedigree and other conditions were similar with the exception of diet. One had the mineral-rich bluegrass of the region at Lexington, Kentucky; the smaller bone shows the influence of malnutrition, this valuable colt having died from this cause on a farm near Cincinnati. The blood analysis of the healthy animal showed 10.5 mg. per cc. of calcium and 5.5 mg. per cc. of phosphorus. The blood analysis of the poorly fed animal showed 5.42 mg. per cc. of calcium and 3.0 mg. per cc. of phosphorus. The bones of the undernourished colt were soft and could be easily cut with a knife. This undernourished animal probably had as much to eat, measured in bulk, as the healthy animal. It demonstrates the fact that, in diet, we are beginning to understand that quantity is not sufficient but our food must be of high quality. By quality foods, we mean those with sufficient minerals and vitamins to build bone, blood and tissues, as well as to provide energy.

Human Health

Where do humans fit into the soil fertility picture? Doctors of medicine and of dentistry are now beginning to see human deformities associated with nutrition and this nutrition goes back to the crop, the season, and the soil itself. Applying the results of a *Federal Dental Survey*, to an erosion map of Ohio, one would draw the conclusion that the children twelve to fourteen years of age in our state living in the eroded eastern and southern counties have already lost twice as many of their permanent teeth as those more fortunate children in the flatter lands of the northwest. Calcium plays an important part in the growth of bone, and is undoubtedly one of the causes of the above condition. The eroded acres in the hilly areas will no longer produce proteins in economic quantities sufficient to warrant planting of crops. Without proteins, the body builders, we cannot replace the normal body wear and tear.

Calcium is necessary to maintain normal blood clotting, normal rhythm to the beat of the heart, normal excitability to the nerves and muscles and proper permeability of membranes so that foodstuffs in solution may flow into and nourish all of the cells of the body. When calcium is deficient, all of these important functions are affected unfavorably. This is especially true in the growing bodies of school children and they become irritable, nervous, and real problems of behavior. Unfortunately, we cannot give the complete story of the role of each of the soil minerals in human health. Others would include iodine, manganese, boron, iron, copper, zinc, sulphur, fluorine, and others previously mentioned.

With the substitution of crops and foods requiring less of the chemical nutrients in the soil has come our need for additional vitamins. Soils rich in available chemical nutrients normally produce abundant vitamin content in foods. Scientific experiments apparently show that some plants can absorb certain vitamins from the soil through their roots. Without adequate minerals, we are producing foods manufactured primarily out of air and water. These woody fibers from poor soils do not digest easily and in order to increase the rate of burning, we may add the drugstore vitamins. We should understand that drugstore vitamins are not foods. They do not furnish energy and are not used as building blocks for the construction of the body. Adequate vitamins come in nature's foods when the vegetation is from rich soil. The commercial vitamin problem probably has resulted mainly from the change in the plant structure and quality as influenced by depleted soils. The depletion has resulted from erosion, over-cropping and leaching.

Let us examine a few examples showing the influence of soils upon vitamins. You purchase tomato juice mainly to secure Vitamin C. Research in Virginia showed that when one part of manganese was added to 15,000 parts of the test soil in Virginia, the Vitamin C content was doubled in the tomato juice. Manganese also increased the Vitamin A and B content. A small application of borax on the ground of an apple orchard in one of our western states more than doubled the Vitamin A content of the fruit.

Milk is the most common food of the human race, every one is a born natural milk drinker. Fine physique, good health and virility are usually seen in races where milk has an important place in the diet. The contrast in health, strength and stamina between the hill tribes of India and the dwellers of the plains is well known. The hill tribes partake largely of milk and enjoy robust health while the plains people exist almost exclusively as vegetarians, mainly cereals. Milk is rich in minerals and vitamins.

The diet of the average American is deficient in calcium. One is not likely to have

an adequate intake unless he is consuming milk or dairy products in sufficient quantities daily. The problem of supplying sufficient milk is indicated by the fact that in Ohio and other states the eroded counties require from four to nine acres to support one animal unit per year while in the fertile acres rich in soil minerals, two acres are enough.

One of the most convincing examples showing the relationship which exists between rich soils and rich vitamins is the study of the Vitamin A in milk. The amount of Vitamin A in cow's milk is due primarily to two substances that occur in the milk fat. The first is carotene and 90% of this material gives butter its natural color and is derived from the feed. *The Bureau of Dairy Industry*, U. S. Department of Agriculture, has found that cows fed on U. S. No. 3 timothy hay had a low Vitamin A potency of fat while No. 1 alfalfa normally contained eight to ten times as much carotene and sometimes as great as fifteen-fold. If a good alfalfa hay is fed, the milk contains 1200 to 2500 Sherman units of Vitamin A per quart. Butterfat from cows fed poor grade timothy has been reported to contain as little as 8 to 13 units. Taking these figures back to the soil, we note that clover and alfalfa may be successfully grown only on mineral rich soils. A recent survey at the Lockheed Aircraft Factory, California, reported a Vitamin A deficiency of 62% among the workers and a deficiency of 70% in Vitamin C. In more than 50% of the cases, the vitamin deficiencies were serious enough to affect the efficiency and endurance of the workers, resulting in decreased production and spoilage, lost time and lowered morale. The present evidence indicates that it would be profitable for many industries to provide a mineral and vitamin rich lunch to the employees without cost in order to gain the increased efficiency of the employees.

The Teacher's Part

It is a part of America's traditions that education is necessary if her children are to become good citizens. Hidden hunger, or deficiencies in vital food elements in the diet are widespread among all our people, but do the greatest harm to our children. These hidden hungers are usually the result of bad food habits, of over-refining foodstuffs, and of destroying the quality of foods by the depletion of soil of its essential nutrient elements through bad farming practices. Unless children are consuming an adequate diet, they cannot be expected to learn or even to want to try to learn. It is known that the intelligence quotient of the hungry malnourished child may move upwards from ten to twenty points after the child has been properly nourished.

We, as teachers, have a place in the struggle to keep our nation strong through saving our soils. It is our duty to sensitize children to the need for conservation of our resources, especially those so vital to life as soil and water. Teach the children in our schools that when they wake up tomorrow, it won't be yesterday. Teach them to go ahead —but with less of the basic resources which have been the foundation of our nation's greatness. Teach our children that it becomes national suicide not to conserve. In closing, may we suggest that you prepare yourself to teach conservation through a most healthful and pleasant out-of-doors educational experience at the Ohio Conservation Laboratory next June.

Editor's Note: An important part of the Conservation Laboratory program is the annual *Conference on Conservation, Nutrition and Human Health*. The program is built around the type of material presented in this paper. The program has received considerable national attention among conservation leaders as well as in the medical profession. This conference will be held June 24–25, 1944; literature will be forwarded to interested teachers. The *Soil Conservation Monthly* for October, 1942 and October, 1943 contains excellent reports of this nutrition program.

The Conservation Education Program in Ohio is financed through the interest of the Ohio Division of Conservation and Natural Resources but administered jointly with the State Department of Education.

(*Continued from page 128*)

publications obtainable in many cases without charge, from the office of your county Agricultural Extension Agent or from your College of Agriculture. The following quotations are from Leaflet 247 of *The Agricultural Extension Service*, Purdue University, Lafayette, Indiana:

Moles

Moles burrow about 3 or 4 inches below ground and raise the soil in ridges in their search for food, which consists largely of insects and earthworms. Damage by moles can be eliminated in the most direct manner by removing the animals from garden plots and adjoining land.

A very unscientific but nevertheless effective way to remove moles from gardens is to visit the garden either in the early morning when moles are quite active or after a rain, particularly a "soaking" rain, when moles are moving rapidly through the soil looking for food. With a spade or shovel, stealthily approach their runways. You can see where they are working by the movement of soil. A quick jab into the soil behind the mole, a flip of the shovel, and the animal is on top of ground. A tap with the shovel will spell the end for the mole. Several moles may be using the same system of runways, so use your foot to level the runways and occasionally observe them for several days to see if new workings appear.

Traps are effective, but scarce due to war conditions.

A repellent substance applied as a barrier on all sides of the plot is fairly effective in keeping moles out of the garden. Use creosote, naphthalene, lysol, or any similar substance possessing a strong odor. These soil barriers are most effective when applied early in the spring. Creosote and many other repellents will kill grass and other plant growth, so avoid such treatment where it will do harm.

Field Mice and Ground Squirrels

Field mice should not greatly concern Victory gardeners, but mice sometimes enter and follow mole runways, eating the seed or roots of plants exposed by the activity of moles. Remove the moles first and level the runways. If damage continues, reduce the infestation of mice. If there is a grassy border at the edge of the garden plot, field mice will likely be present. Strychnine-poisoned oats bait placed in their runways under the matted grass is the most effective control method if considerable numbers of mice are present or if a rather large area of land must be freed of mice. Otherwise, if only a limited infestation is present, ordinary mouse traps can be used with good effect.

Ground squirrels can be controlled with the oats bait suggested above. To treat, place a teaspoonful on hard surface near a hole.

Woodchucks (Groundhogs)

Gardens located near rough, hilly, or otherwise waste land may be damaged by woodchucks or groundhogs. Treatment of dens with fumigants, thus destroying the animals, is the most practical control method. This treatment should be applied only during the months of April, May, and June, (preferably early in April) thus avoiding the destruction of other animals that use the groundhog dens in fall and winter.

Pocket Gophers

Pocket gophers burrow from 4 to 8 inches below ground, sometimes much deeper, and throw up mounds at frequent intervals. To poison, locate the runway near a freshly made mound with an end-gate rod or other prod. The main tunnel runs about 2 feet from the flat side of the mound. (Note the tiny mound on the larger one—it is on the flat side and indicates the location of the runway.) When the runway is located with the small rod, use a broomstick to enlarge the opening and drop into it 2 or 3 pieces of vegetable bait or a teaspoonful of strychnine-treated oats bait. One such treatment for every 6 to 10 fresh mounds should suffice. Vegetable bait is prepared by cutting sweet potatoes or carrots into pieces 1½ inch long and ½ inch square and dusting 2 quarts of the pieces with ¼ ounce of powdered strychnine (alkaloid). Stir the bait to get an even coverage.

Rats

Rats move into the open, away from buildings, during the warm months of the year. Infestations of rats that affect gardens are usually located in burrows in the ground near garden plots. Rats can be destroyed quite easily by applying calcium cyanide fumigant to their burrows with a dust gun. Special dusters are preferred and they can be purchased from any insecticide dealer. Force the calcium cyanide dust into the burrows, then close all openings. The dust creates a gas which destroys rats. Avoid breathing the dust so far as possible. Use it only outdoors.

Poisoned baits can be used for treatment of areas adjacent to gardens where calcium cyanide would be impractical. Prepared red

squill baits are available at low cost for community treatment. Further information concerning prepared bait can be obtained from your county agricultural agent.

Bird Pests

Several species of birds may damage garden plants. Blackbirds and crows are the most troublesome due to their attacks on corn immediately after planting and also when it is in the "milk" or "dough" stage.

Frightening devices usually prove very effective, particularly if they are changed frequently during the period the garden needs protection. Thus, one may put up tall sticks or poles (6 to 8 feet or higher) around the garden with one or two strands of twine or heavy cord strung between the poles. After a few days fasten pieces of white paper at intervals on the string, then in two or three days change to a bright colored paper, and so on. Pieces of metal or mirror that reflect light from the sun, or objects that make noise in the wind can be substituted for the paper. These scares are easy to install but birds will get used to them, hence the need to change them frequently during the few weeks that birds may be injurious.

Collecting Spring Peepers

DONALD S. LACROIX
Amherst High School, Amherst, Massachusetts

The spring "peeper" (*Hyla crucifer*)* is rarely seen by the beginning biologist unless this little amphibian appears in the museum as a preserved specimen. It is much more fun to observe living ones, and a study of their modes of life and ecology is truly instructive.

* *Hyla crucifer* is common throughout eastern and central North America. Two other small amphibians which "peep" are the Cricket Frog (*Acris gryllus*) and the Swamp Cricket Frog (*Pseudacris triseriata*). The latter species range farther to the west and southwest than does *Hyla*. Their breeding habits are similar and habitats identical.

Fig. 1. A "night" field trip—looking for spring peepers. Photo by D. S. Lacroix.

This tiny frog is not seen easily during daylight hours even though his shrill note attracts attention, but at night, his whereabouts is readily spotted by using a flashlight (Fig. 1). For some reason he doesn't mind the light of an electric torch. Boys and girls can find hundreds of specimens in any swampy or boggy area in the early spring. All that is needed for equipment is a pair of rubber boots, a flashlight and some sort of container to bring back a few of the frogs. In attempting to find the peeper, try wading around in the shallower parts of the area to be covered. Care should be observed not to cause too much commotion as the peeper will "shut up" if his perch is shaken. Two people approaching from opposite sides can locate him by his note, and his white, distended vocal sac will stand out clearly in the rays of a flashlight (Fig. 2). He sings his mating song from the vantage point of a stick, grass-stem, or floating debris only a few inches above the surface of the water, and will continue to peep vociferously if not jarred or jiggled.

In collecting these small animals, place them in a moist atmosphere—in a tin can containing wet grass, damp moss, or moist leaves—not directly in water. Bring them in to the biology laboratory and keep them in a terrarium or aquarium. If in the former, have a small "water-hole," ferns and damp moss available. If in the latter, provide a place for them to rest above the water line. Small worms and small insects are their favorite foods.

If a dozen or more are kept in the laboratory, their shrill notes may disturb near-by classrooms, but in any case they will advertise themselves so well that all persons passing by will be tempted to investigate.

FIG. 2. The spring peeper, *Hyla crucifer*, singing his spring song with plenty of pressure on his vocal sac. Photo by R. L. Coffin.

Garden Education in the High School

PAUL H. JONES
Director, Fordson Horticultural Gardens, Fordson Public Schools, Dearborn, Michigan

The food that can be produced through successful gardening has attracted wide interest. The war and subsequent rationing have made the citizens of the United States aware of the passing of the era of plenty.

It is imperative that boys and girls and young men and women appreciate the importance of maintaining land and plants that will produce a superior food supply. A prevalent American concept of food production has been that all that is required is to plant seed and to harvest crops from our unlimited agricultural land resources. This concept clearly shows that the American biologist has not given to youth the leadership and foundational training which is necessary to understand food production. Good food is produced by seeds from superior parents cultivated in good land. Superior plants are produced by the plant breeder. This is a specialized application of biology. The use of mathematics and an application of the chemicals known to influence biological activity are hand tools of the plant breeder. It is just as important to appreciate a new plant as it is a new tool, machine, car, or aeroplane. The success of a superior plant may change the course of a community or a nation. Mismanaged soil is not an aid to production. When soil is mismanaged it not only injures the plants which insure the food supply but it changes the course of industrial and agricultural procedure. These are examples of the rule that there is nothing constant but constant change.

Planning to cope with constant change is one of the basic reasons for the teaching of biology. Preparation for meeting and understanding the broad application of biological principles to all society is available when a garden is used in connection with the High School Biology

Course. The planning involved will make the instructor a biologist whose opinion is respected. He can demonstrate what he knows by the use of this experimental garden located on school property outside the laboratory.

Great and significant biological discoveries have been made in a garden. Mendel made his discoveries there, and there Linnaeus found his life's interest. Liebig made himself famous as a chemist by converting worthless land to fertile, productive soil. The practice of biodynamic gardening and farming today is a challenge to all gardening and agricultural procedure and also to the industry that has been developed to produce farm tools and process food.

The place in the school curriculum to begin garden education is in the late elementary school and the early junior high school by practical courses in school gardening. Individual garden plots located on school property should be a part of the plan for garden education at this level. Garden education in high school biology should be treated as a unit in the course to coordinate the academic training given in plant and animal life. The unit should be thoroughly practical, explanatory, informative, and useful in the home garden. It should strive to go beyond elementary gardening.

High school biology should not be converted to gardening any more than it should be converted to conservation or public health. These subjects should be pursued as units of instruction. Biology has foundational, not terminal objectives.

A practical sequence to high school biology is a course in horticulture.* The foundational training for horticulture is given in biology and suplemented by chemistry and physics. This combination of studies builds for the student an approach to understanding much of the world's work and its daily relation to the plant, chemical, and machine requirements necessary to produce an adequate food supply. Beyond this large objective the student should learn:

(1) How to live on land in his own community.
(2) What are the limitations within our nation to the production of a complete supply of horticultural foods.
(3) What is the relationship of horticultural food production to our nation's social problems.
(4) Where is the source of the supply of plants that can be cultivated in our own backyard garden.
(5) How to use city land wisely.
(6) How to prepare to become a food merchant, a buyer of food for home use, a botanist, an entomologist, a plant breeder, a plant chemist, a chemurgist, a florist, a professional gardener, a seedsman, an orchardist, a vegetable grower, a small fruit producer, a greenhouse manager, a nurseryman, a tree surgeon, a landscape architect, or a horticultural research worker.

America needs to garden. Schools have an educational responsibility to give leadership and helpful guidance.

* Horticulture is used in the science sequence in the Fordson High School. It is accredited by the University of Michigan. It is an area of instruction in garden education.

In the April number: *Conservation Unit III*, dealing with the conservation of fishes, an article on *Wartime Student Research*, another column of *Recent Publications*. . . . Officers of state and local organizations; be sure to send reports of your activities to Mr. Prevo L. Whitaker, University High School, Bloomington, Indiana, as promptly as possible. . . . If you have any suggestions for the Photography Issue, send them to Mr. Richard F. Trump, Ames Senior High School, Ames, Iowa. . . . Dr. L. K. Darbaker, School of Pharmacy, University of Pittsburgh, Pittsburgh 19, Pennsylvania, has available mimeographed outlines of *Poisonous Plants of Western Pennsylvania* and *Some Medicinal Plants of Western Pennsylvania;* send 5¢ for postage for each outline. Dr. Darbaker has submitted a manuscript on drug plants, which will appear in an early issue of The American Biology Teacher.

Biological Briefs

HOFFMAN, WILLIAM S. *The Use of Sulfa Drugs in Medicine and Surgery.* The Science Teacher 10 (3): 7–9; 30–31. October, 1943.

The ten-year history of the development and use of the sulfa drugs is one of remarkable progress and medical value. Originally introduced and patented in the form of azo dyes by Germany, the drug was released from patent restrictions by the work of Fourneau of France, who demonstrated that the active principle in the human body was sulfanilamide. America's recognition of the new field came late in 1936, and since then investigations in this country have almost monopolized it. Because of their wider effectiveness in coccus infections and of their lessened toxicity, the derivatives sulfapyridine and sulfathiazole are largely replacing sulfanilamide, with sulfadiazine gaining in popularity. All are effective in treating Beta-hemolytic streptococcus infections; sulfapyridine is best in pneumococcus treatment and sulfathiazole in gonococcus control, while sulfaguanidine and sulfasuxidine are used against some gastrointestinal infections and sulfacetamide in urinary infections. Staphylococcal infections, as well as virus diseases, malaria, typhoid fever, syphilis, and tuberculosis, have not responded to sulfa treatment. The drugs are usually given by mouth, though they may be given in solution intravenously, and sulfathiazole is made up in an ointment. Of importance in prophylaxis, wounded soldiers are asked to swallow sulfathiazole tablets immediately, and the powdered drugs are liberally sprinkled over the site of abdominal operations. Since toxic reactions do occur, sulfa treatment must at all times be under close medical supervision. The mode of action of the drugs is not as yet clear. We know that they do not act as an antitoxin nor promote the formation or action of antibodies, but rather inhibit bacterial growth, possibly by competing with members of the B-vitamin complex for certain enzyme systems necessary for bacterial proliferation.

WARD, J. D. U. *Bloodletters.* Fauna 5: 80–81. September, 1943.

A century ago the use of medicinal leeches for everything from black eyes to obesity was so widespread that 57,000,000 a year were used in France alone. There is still a restricted use for them, and they may be bought in our larger cities. Our native species are far less abundant than they once were, a result of stream pollution. From a Y-shaped incision the medicinal leech withdraws about one-half ounce of blood, to be stored and used as a year's supply of food; however, bleeding from the bite may continue until two to six ounces have been lost. The saliva of the leech contains a factor inhibiting blood clotting. Keeping the engorged leech was not profitable, so it was forced to regurgitate by immersing it in vinegar or camphor water.

DELF, E. MARION. *Nature and Uses of Seaweeds.* Nature 152: 149–152. August 7, 1943.

Much progress has been made in the study of seaweeds in the past fifty years. The study of alternation of generations has led to the possibility of raising certain commercially valuable types. The kind of alga developing along a shore depends partly on the type of anchorage available and partly on position with respect to the tidal range. In agriculture, seaweeds are used as fodder or as manure. They are eaten in the Orient and also along the northwest coasts of Europe, though it is not known precisely how much food value they provide. They are rich in mineral salts, particularly iodides. Before cheaper sources were available, kelp was harvested as a source of potash; now its chief commercial uses are for its mucilaginous products. Under suitable treatment these can be used as rubber substitutes, transparent films, artificial cloth fibres, and colloidal bases in many products. Agar is used extensively in laxative preparations and almost universally as a base for bacterial and fungal cultures. Seaweeds from California and other coasts are being used to replace the Japanese sources of agar.

MOCK, HARRY E., and MOCK, HARRY E., JR. *Refrigeration Anesthesia in Amputations.* Journal of the American Medical Association 123: 13–17. September 4, 1943.

The writers report on their experience with cracked ice refrigeration to control infection in limbs seriously affected by diabetes or mechanical injury, and as the only anesthesia used for their amputation. Except for a slight delay in healing, they have found no disadvantages. In cases where a patient's physical condition has not allowed an immediate amputation, refrigeration without a tourniquet has delayed the development of gangrene for as long as 2½ weeks. Where refrigeration is used as the only anesthetic for an amputation, no shock or pain is felt either during the operation or afterwards, and in diabetic patients diet and insulin dosage may be continued without missing a meal.

RUTH SHERMAN STEIN

Reviews

PITLUGA, GEORGE E. *Science Excursions into the Community.* Bureau of Publications, Teachers' College, New York. viii + 154 pp. Illus. 1943.

Entitled *A Handbook for Teachers in Grades Four to Eight,* this book contains basic suggestions that could be used to grades nine and ten. The book is written in an easy style, it is comprehensive in content, and progressive in thought. To quote Mr. Pitluga on page 1, "One of the most obvious trends in elementary science teaching has been the organization of science experiences around larger meanings or generalizations." He has succeeded well in presenting matter that develops this pertinent thought. The introduction is interesting; Chapter II argues well for excursions as teaching technique; Chapter III presents worthwhile considerations for the teacher before planning an excursion program. The body of the book develops fourteen very timely excursions. In each one the author presents aims, contributing facts and generalizations, possible approaches, thoughts in introducing the materials involved, a teachers' bibliography, preparations for the excursion, suggestions for the excursions, follow-up activities and a children's bibliography. In his last chapter he suggests 45 experiments, with 14 illustrations, that may be performed by the teachers or pupils effectively and inexpensively. To the experienced teacher this book is a refreshing source for renewing interests; and to the young teacher it is a fountain of suggestions, encouragement, inspiration and contagion for science excursions *into* the community.

GUY F. WILLIAMS.
Colby Junior College,
New London, New Hampshire

MALCOLM DIXON, With a Foreword by Sir F. G. Hopkins. *Manometric Methods.* 2nd ed. Cambridge University Press; The Macmillan Company, New York. xiv + 155 pp. Illus. 1943. $1.75.

The scope and purpose of this book are so well described in the Foreword by Sir F. G. Hopkins that quotations supply an adequate review.

"While the importance of manometry as applied to the respiration of isolated tissues and micro-organisms is rightly emphasized, it should not be forgotten that the progress of individual chemical reactions can be accurately studied by its aid, in the case for instance of enzyme-catalyzed oxidations, and also in many other cases. That it displays great accuracy as a micro-method is one of its advantages.

"In the development of manometry in the Cambridge Biochemical Laboratory my colleague, the author of this book, has played the leading part. Dr. Dixon was one of the first to use its methods with discrimination, and for some years he has given close and continuous attention to its growing technique. Apart from his own contributions to this, he has made himself very familiar with all the instruments and methods described in his book. He has used them all, and sedulously compared their relative merits. He writes, therefore, with authority.

"Manometric methods have now been much employed in many laboratories, but it will be admitted, I think, by all who read the literature, that manometers have not always been used with due discrimination. It is a fact that the theoretical principles which underlie the behavior of this or that form of manometer are less simple than those who give no thought to them are apt to realize, and the use of any form without due regard to these principles may involve errors of no negligible magnitude.

"It is the great merit of this book that it provides an adequate and clear account of the theory involved in each of the methods described. To do this is part of its essential purpose and nowhere else has the task been attempted.

"Part I of the book is devoted to a discussion of principles. Part II supplies guidance in detail for the use of the various methods which are now available. Much ingenuity has been displayed of late in the construction of new forms of manometric apparatus, each having merits of its own, and each perhaps possessing advantages over others for some particular purpose. As would be expected, however, those most recently described would seem to have advantages over earlier forms. Each method, however, calls for its own precautions and for attention to details which vary in importance from case to case. All such matters are fully dealt with in the pages which follow. I cannot indeed discover that any information necessary for the successful use of manometric method is here lacking."

PHILIP E. FOSS,
Hartford Public High School,
Hartford, Connecticut

Anatomical Charts. RUDOLF SCHICK, Publisher, 700 Riverside Drive, New York 31, N. Y.

This series of wall charts, most of them printed in color, ranging in size from 19 × 31 inches to 30 × 54 inches, depicts various hu-

man anatomical and physiological subjects. A partial list is as follows: Human Body with Viscera and Blood Vessels in situ, Body with Bones, Muscles and Nerves, Eye, Ear, Heart, Skin, Circulation of the Blood, Digestive Tract, Development of the Human Body, Nutritive Values of the Common Foods, Human Body as a Factory, Endocrinology, Human Skeleton with Principal Arteries and Pressure Points. Numbered keys accompany the charts. The illustration is clear and sharp, with important features large enough to be visible at classroom distance. Chart No. 8, The Human Body as a Factory, is specially interesting, showing the digestive, respiratory, circulatory and control processes as integrated parts of a "factory," with conveyor tubes, storage tanks, telephone lines, etc. The charts are mounted on linen and are available with or without spring rollers, with prices ranging from $4.75 to $8.50, depending on size and type of mounting.

JOHN BREUKELMAN

FORMULAS FOR BIOLOGICAL SCIENCE

THIS FORMULA is to be used for preparing crayfish so that they may be handled as if they were made of rubber. I have three specimens that I have been using for over a year, which are still in good condition.

FOR CRAYFISH

1. Place specimen in a weak solution of formalin, 5%, for 12 hours.
2. Submerge in a saturated solution of NaCl for 12 hours.
3. Wash in water.
4. Submerge in water for 12 hours.
5. Submerge in a solution of equal parts of glycerin and water for 12 hours.
6. Wash in water.
7. Let the specimen dry for about two weeks. They will be free from offensive odors, and may be handled without fear of the appendages being easily broken.

ROY JAMES WATSON,
London Public Schools,
New London, Texas

EDITOR'S NOTE: Several readers have written concerning the formula for formaldehyde solutions, page 47 of the November issue. This formula was printed just as received, but there should have been some explanation of the confusion between "formaldehyde" and "formalin." *Formaldehyde* is the name of the chemical, CH_2O, which is dissolved in water. A solution of 40% of this chemical in water is known as *formalin*. Solutions based on this stock as 100% should be named *formalin* solutions, *not formaldehyde* solutions.

Thus: formalin = 40% formaldehyde
50% formalin = 20% formaldehyde
10% formalin = 4% formaldehyde
8% formalin = 3.2% formaldehyde
5% formalin = 2% formaldehyde

The formula given in the November issue was for *8% formalin, i.e.,* 8 parts of the stock solution in a total of 100 parts of the final solution; this is *3.2% of formaldehyde* in the final solution.

In our own laboratory we generally use a 10% formalin (4% formaldehyde) solution for zoological specimens. We keep on hand a graduate marked at 380 cc. and place this amount of the stock solution in a gallon bottle kept for the preserving solution, then fill the bottle with water. This is approximately a 10% solution of the stock, since a gallon equals about 3800 cubic centimeters.

FROM THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

Official records of *The National Foundation for Infantile Paralysis* show that most of the more than 12,000 cases of poliomyelitis reported in the United States during 1943 involved children between the ages of five and fifteen. Many of them will still be patients in 1944, and some for years thereafter.

To aid the *National Foundation,* there are several ways in which schools and school children can cooperate. This year's suggestions include:

1. Hold inter-class or intra-mural poster and essay contests based on the fight against infantile paralysis.

2. Dramatic programs and recitations in school auditoriums. A play-writing contest could be held with an appropriate prize going to the child writing the sketch which best presents the story of poliomyelitis.

3. Evening programs in auditoriums featuring talks by local doctors or nurses, advising parents of the symptoms of infantile paralysis and describing the action to be taken when those symptoms appear.

4. Hold a bazaar in the school auditorium with the children offering for sale articles made by themselves in sewing or manual training classes, the proceeds to be turned over to the National Foundation.

5. Let *Infantile Paralysis Week* be a *Do Without Week*. Place a special box in each class room and suggest that the children do without such luxuries as candy, ice cream, movies, etc., and each day drop the money they would have spent on these things.

Full information may be had by contacting local Chairman or local Chapters of the National Foundation, or the National Foundation itself, 120 Broadway, New York 5, N. Y.

CHICAGO CATHOLIC SCIENCE TEACHERS' ASSOCIATION

The Chicago Catholic Science Teachers' Association held its twentieth meeting at Loyola University, December 28, 1943. The program was as follows:

GENERAL SESSION

Chairman: Brother Reginald, C.S.C., University of Notre Dame, President of the Association.

ADDRESS OF WELCOME

The Reverend Joseph Egan, S.J., President of Loyola University.

ADDRESS: "SCIENCE AND LEARNING"

Sister Mary Ellen O'Hanlon, O.P., Chairman, Department of Biology, Rosary College.

BUSINESS MEETING

TOUR OF THE CAMPUS

LUNCHEON

SECTION MEETINGS

SOLEMN BENEDICTION OF THE MOST BLESSED SACRAMENT

Madonna Della Strada Chapel

The Reverend C. J. Wideman, S.J., Celebrant.

The Reverend V. B. Nieporte, S.J., Deacon.

Mr. P. D. Keller, S.J., Subdeacon.

At the organ: Mr. Stanley J. Anstett, Organist, Saint Gertrude Church.

The program of the *Biology Section*, with Sister Mary Cecilia, of Mundelein College presiding, was as follows:

The Cancer Problem in High School. Brother H. Charles, F.S.C., Saint Mary College, Winona, Minnesota.

Growth Activators in Plants. Sister Mary De Lourdes, B.V.M., Saint Mary High School, Chicago, Illinois.

Penicillin, the Modern Miracle. Miss Dorothy M. Homan, Armour Research Institute, Chicago, Illinois.

BY THE WAY

FLUORESCENT DESK LAMPS with 15 watt, 18 inch × 1 inch daylight tubes are nearly ideal both for dissection and microscopic work. Two or more students may use one lamp. The initial cost is small and the tubes are very durable. In one laboratory only one tube had to be replaced during eighteen months of almost constant daily use.

VALLISNERIA, recommended in the Dec. 1942 *By the Way*, is just as good a summer aquarium plant. Oxygenation is more important in summer because the oxygen capacity of water decreases as the temperature of the water increases. Vallisneria remains healthy in exceptionally trying aquarium conditions.

EAR OSSICLES, in sets, may be recovered from a skull, of horse, calf, sheep, cat or dog. The lower jaw of a turkey or a chicken can be marked in colored areas to show the equivalent elements. Sets may be mounted on cards and hung on the wall. Break off the bony wall of the skull; do not pry the ear ossicles out of the canal; they are fragile.

BIOLOGY SLIDEFILMS

Eight rolls comprising 288 detailed drawings and descriptions of all important invertebrate and vertebrate animals on 35 MM SLIDEFILMS project to full screen size.

Slidefilms in all High School sciences.

Visual Sciences—264C, Suffern, N. Y.

KODACHROME 2 x 2 LANTERN SLIDES

covering, for ordinary teaching requirements, every field of interest to the teacher of biology and physiology, including animal and plant histology, bacteriology and parasitology. Pre-nurse training and pre-medical and pre-dental subjects a specialty. Thousands in use from coast to coast. More than fifteen hundred C.B.S. master slides available for duplication, also, Holt and Ingles extensive collections of Calif. plant and animal Kodachromes. Lists and prices on request.

CALIFORNIA BIOLOGICAL SERVICE

1612 W. Glenoaks Blvd., Glendale–1, Calif.

Field Collecting Equipment

War-created shortages have stopped the manufacture of some types of nets and other special field equipment, but most needed items are still available for prompt delivery. Refer to your Turtox Biology Catalog, or write to us for air and aquatic nets, killing jars, insect pins, spreading boards, vascula, plant presses and other items needed for your field work this spring and summer.

GENERAL BIOLOGICAL SUPPLY HOUSE
Incorporated

761-763 East Sixty-Ninth Place, Chicago 37, Illinois

The Sign of the Turtox Pledges Absolute Satisfaction

Your Biological News

You would not go to the library to read the daily newspaper—probably you have it delivered at your home to be read at your leisure. Why, then, depend upon your library for your biological news?

Biological Abstracts is news nowadays. Abstracts of all the important biological literature are being published promptly—in many cases before the original articles are available in this country. Only by having your own copy of *Biological Abstracts* to read regularly can you be sure that you are missing none of the literature of particular interest to you. An abstract of one article alone, which you otherwise would not have seen, might far more than compensate you for the subscription price.

Biological Abstracts is published in seven low priced sections, as well as the complete edition, so that the biological literature may be available to all individual biologists. Section A, which includes General Biology, Biography-History, Bibliography, Evolution, Cytology, Genetics, Biometry and Ecology, is only $4 per volume (Foreign, $4.50). Ask for a sample copy.

BIOLOGICAL ABSTRACTS
University of Pennsylvania
Philadelphia, Pa.

WHAT *does this man see?*

Under this Spencer Microscope is a cutting tool—one of many especially designed to speed the production of the famous Bell Airacobra, "the cannon on wings."

The engineer who is studying it sees far more than a clear, stereoscopic magnification of its detail. In his mind's eye, he sees a record-breaking production of American fighting planes, for he is one of the many specialists guiding our great airplane factories in war production.

To meet the unprecedented wartime needs, Spencer has greatly multiplied its manufacturing facilities. These facilities, plus nearly a century of experience, today are being devoted to war.

ARMY E NAVY

Spencer LENS COMPANY
BUFFALO, NEW YORK
SCIENTIFIC INSTRUMENT DIVISION OF
AMERICAN OPTICAL COMPANY